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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

NICHOLAS L. ABBOTT et al.

Continuation of Application
No. 09/127,382

Filed: July 31, 1998

For: OPTICAL AMPLIFICATION OF
MOLECULAR INTERACTIONS USING
LIQUID CRYSTALS

Examiner: Celsa, B.

Art Unit: 1627

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examination of the above-referenced application, please enter the following amendments and remarks.

IN THE SPECIFICATION:

Please amend the Specification as follows.

(1). At page 1, beneath the title please add:

--Cross Reference to Related Applications

This application is a continuation of U.S. Patent Application No. 09/127,382, filed on July 31, 1998, which is a continuation in part of U.S. Patent Application No. 09/092,453, filed on June 5, 1998, now abandoned, the disclosures of both of which are incorporated herein by reference in their entirety for all purposes.--

(2). At page 9, please delete the paragraph (lines 21-27) and replace it with the following:

--Fig. 1B is a scanning tunneling microscopy image of the surface of a thin (~ 10 nm), semitransparent, obliquely deposited (50E from normal) gold film prepared by electron beam evaporation onto a glass substrate at 0.02 nm s⁻¹. A layer of titanium (~ 200 nm, also deposited obliquely) was used to promote adhesion between the gold and the glass. The vertical and horizontal dimensions of the image are 300 nm and 500 nm, respectively. The gray scale of contrast represents a height range of 0 to 5 nm.--

(3). At page 16, please delete the paragraph (lines 17-24) and replace it with the following:

--The term "alkyl" is used herein to refer to a branched or unbranched, saturated or unsaturated, hydrocarbon radical having from 1-30 carbons and preferably, from 4-20 carbons and more preferably from 6-18 carbons. When the alkyl group has from 1-6 carbon atoms, it is referred to as a "lower alkyl." Suitable alkyl radicals include, for example, structures containing one or more methylene, methine and/or methyne groups. Branched structures have a branching motif similar to i-propyl, t-butyl, i-butyl, 2-ethylpropyl, etc. As used herein, the term encompasses "substituted alkyls."--

(4). At page 17, please delete the paragraph (lines 8-10) and replace it with the following:

--The term "arylalkyl" is used herein to refer to a subset of "aryl" in which the aryl group is linked to or integrated into R¹ or R² shown in Formulae 1 - 4 by an alkyl group as defined herein.--

(5). At page 17, please delete the fourth paragraph (lines 18-20) and replace it with the following:

--"Substituted arylalkyl" defines a subset of "substituted aryl" wherein the substituted aryl group is linked to or integrated into R¹ or R² shown in Formulae 1 - 4 by an alkyl group as defined herein.--

(6). At page 18, please replace the second paragraph (lines 4-7) with the following:

--As used herein, the term "acylamino" describes functional groups of the general formula $RC(O)NR'$, wherein R' is a lower alkyl group and R represents a component of either R^1 or R^2 shown in Formulae 1 - 4 or an alkyl group, as defined herein, attached to either R^1 or R^2 .--

(7). At page 18, please replace the third paragraph (lines 8-14) with the following:

--The term "acyloxy" is used herein to describe an organic radical derived from an organic acid by the removal of the acidic hydrogen. Simple acyloxy groups include, for example, acetoxy, and higher homologues derived from carboxylic acids such as ethanoic, propanoic, butanoic, *etc.* The acyloxy moiety may be oriented as either a forward or reverse ester (*i.e.* $\text{RC(O)OR}'$ or $\text{R}'\text{OC(O)R}$, respectively), and may be integral to R^1 or R^2 or a substituent of R^1 or R^2 , wherein R comprises a portion of the ester derived from R^1 or R^2 shown in Formulae 1 - 4.--

(8). At page 18, please replace the fourth paragraph (lines 15-18) with the following:

--As used herein, the term "aryloxy" denotes aromatic groups which are linked to R^1 or R^2 or are a constituent of R^1 or R^2 shown in Formulae 1 - 4, directly through an oxygen atom. This term encompasses "substituted aryloxy" moieties in which the aromatic group is substituted as described above for "substituted aryl."--

(9). At page 18, please replace the fifth paragraph (lines 19-23) with the following:

--As used herein "aryloxyalkyl" defines aromatic groups attached, through an oxygen atom to an alkyl group, as defined herein. The alkyl group is linked to or integrated into R^1 or R^2 as shown in Formulae 1 - 4 by an alkyl group as defined herein shown in Formula 1 - 4. The term "aryloxyalkyl" encompasses "substituted aryloxyalkyl" moieties in which the aromatic group is substituted as described for "substituted aryl."--

(10). At pages 18 and 19, please replace the last paragraph starting on page 18 (lines 30-31) and ending on page 19 (lines 1-2) with the following:

--The term "unsaturated cyclic hydrocarbon" is used to describe a non-aromatic group with at least one double bond, such as cyclopentene, cyclohexene, *etc.* and substituted analogues thereof. These cyclic hydrocarbons can be single- or multi-ring structures.--

(11). At page 19, please replace the third paragraph (lines 13-15) with the following:

--"Heteroarylalkyl" defines a subset of "heteroaryl" wherein an alkyl group, as defined herein, links the heteroaryl group or integrates it into R¹ or R² shown in Formulae 1 - 4.--

(12). At page 19, please replace the fifth paragraph (lines 23-25) with the following:

--"Substituted heteroarylalkyl" refers to a subset of "substituted heteroaryl" as described above in which an alkyl group, as defined herein, links the heteroaryl group or integrates it into R¹ or R² shown in Formulae 1 - 4.--

(13). At page 19, please replace the sixth paragraph (lines 26-30) with the following:

--The term "heterocyclic" is used herein to describe a saturated or unsaturated non-aromatic group having a single ring or multiple condensed rings from 1-12 carbon atoms and from 1-4 heteroatoms selected from nitrogen, sulfur or oxygen within the ring. Such heterocycles are, for example, tetrahydrofuran, morpholine, piperidine, pyrrolidine, *etc.*--

(14). At page 20, please replace the second paragraph (lines 3-5) with the following:

--The term "heterocyclicalkyl" defines a subset of "heterocyclic" wherein an alkyl group, as defined herein, links the heterocyclic group or integrates it into R¹ or R² shown in Formulae 1 - 4.--

(15). At pages 79 and 80, please replace the last paragraph on page 79, beginning on page 79 (lines 29-34) and ending on page 80 (lines 1-5) with the following:

--In contrast to grating B, the diffraction of light by the grating in Fig. 15C (grating C) was polarization insensitive. When grating C was viewed under crossed polars,

either uniformly bright stripes (Fig. 18D polarization of incident light between x and y) or uniformly dark stripes (polarization of incident light along x or y) was observed. The boundaries between stripes, which correspond to regions in which two different distortions of the mesogens meet, were visible in the optical micrographs (dark lines in Fig. 18D). The lack of measurable contrast between adjacent stripes for all polarizations of incident light is consistent with the mesogenic layer structure of grating C. A similar type of layer structure has been reported by Chen and co-workers who use a two-step rubbing process (Chen *et al.*, *Appl. Phys. Lett.* **67**, 2588 (1995)).--

(16). At page 80, please replace the third paragraph (lines 15-32) with the following:

--Tuning of these patterned mesogen structures was possible by using electric fields. When gold surfaces supporting SAMs were used as electrodes, an electric field could be applied perpendicular to the surfaces. Reversible application of the electric field reorients the mesogens and thus modulated the intensity of light diffracted from the gratings (Fig. 19E). In-plane electric fields were also used (in-plane switching refers to the use of an electric field that is applied parallel to the surface of the cell). Devices based on in-plane switching of a mesogen have been used in FPDs with wide viewing angles (Ohe *et al.*, *Appl. Phys. Lett.* **69**, 623 (1996); Ohta *et al.*, *IEICE (Inst. Electron. Inf. Commun. Eng.) Trans. Electron.* **E79-C**, 1069 (1996)) to reorient these patterned mesogenic structures. We observe SAMs to be stable upon application of an electric field across a cell filled with mesogen. Past studies have reported electrochemical desorption of SAMs in aqueous solutions of electrolytes (Widrig *et al.*, *J. Electroanal. Chem.* **310**, 335 (1991); Waliquid crystalzak *et al.*, *Langmuir* **7**, 2687 (1991)). In general, the alignment of mesogens on SAMs formed from long-chain alkanethiols is stable over months. Stability over years can be achieved by using polymerizable SAMs (T. Kim *et al.*, *Langmuir* **12**, 6065 (1996)) or mesogens doped with alkanethiols or reducing agents to prevent oxidative degradation of the SAMs.--

IN THE DRAWINGS

The drawings include a single typographical error on page 2 of 25 of the formal drawings. "Fig. 1B" should be labeled --Fig. 1C--. A redlined page 2 of the formal drawings has

been enclosed in addition to a corrected substitute page 2 to be made of record in the present application.

IN THE CLAIMS:

140. Please cancel originally filed claims 1-120, replacing them with new claims 121-

--121. (New) A method of visually detecting an analyte-recognition moiety complex formed by an interaction between an analyte and a recognition moiety for said analyte by transducing said interaction to an organic mesogenic layer, said method comprising:

(a) interacting said analyte with a patterned surface comprising said recognition moiety, thereby forming an analyte-recognition moiety complex, said surface comprising:

(i) a substrate;

(ii) a self-assembled monolayer bound to said substrate; and

(iii) said recognition moiety bound to said self-assembled monolayer;

(b) contacting said analyte-recognition moiety complex with said organic mesogenic layer, thereby anchoring said organic mesogenic layer onto said self-assembled monolayer and causing at least a portion of a plurality of mesogens proximate to said recognition moiety to detectably switch from a first orientation to a second orientation, thereby transducing said interaction to said mesogenic layer, said transducing causing said mesogenic layer to register a visually detectable feature; and

(c) visually detecting said feature.

122. (New) The method according to claim 121, wherein said patterned surface comprises a patterned self-assembled monolayer.

123. (New) The method according to claim 121, wherein said patterned surface comprises a patterned substrate.

124. The method according to claim 121, wherein said patterned surface is produced by a method which is a member selected from the group consisting of grooving, photolithography, photoetching, chemical etching, mechanical etching, microcontact printing and combinations thereof.

1 125. (New) The method according to claim 121, wherein said patterned surface
2 comprises features having a size of from about 1 micrometer to about 1 millimeter.

1 126. (New) The method according to claim 125, wherein said patterned surface
2 comprises features having a size of from about 200 nanometers to about 10 micrometers.

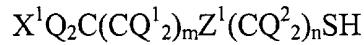
1 127. (New) The method according to claim 121, wherein said patterned surface
2 comprises at least one feature which is a member selected from the group consisting of wells,
3 enclosures, partitions, recesses, inlets, outlets, channels, troughs, diffraction gratings and
4 combinations thereof.

1 128. (New) The method according to claim 127, wherein said at least one
2 feature is a plurality of wells, wherein each member of said plurality of wells is fluidically
3 isolated from the other members of said plurality of wells.

1 129. (New) The method according to claim 127, wherein each member of said
2 plurality of wells comprises a depression and at least one border, wherein said border extends
3 vertically above said depression and said border comprises a compound which is a member
4 selected from the group consisting of hydrophobic compounds, hydrophilic compounds and
5 charged compounds.

1 130. (New) The method according to claim 121, wherein said patterned surface
2 anchors said mesogenic layer.

1 131. (New) The method according to claim 121, wherein said self-assembled
2 monolayer is formed from:



4 wherein,

5 X^1 is a member selected from the group consisting of H, halogen and recognition
6 moieties;

7 Q, Q^1 and Q^2 are independently members selected from the group consisting of H
8 and halogen;

9 Z¹ is a member selected from the group consisting of —CQ₂—, —CQ¹₂—,
10 —CQ²₂—, —O—, —S—, —NR⁴—, —C(O)NR⁴ and R⁴NC(O)—,
11 in which;

12 R⁴ is a member selected from the group consisting of H, alkyl, substituted
13 alkyl, aryl, substituted aryl, heteroaryl and heterocyclic groups;
14 m is a number between 0 and 40; and
15 n is a number between 0 and 40.

1 132. (New) The method according to claim 121, wherein said recognition
2 moiety comprises a member selected from the group consisting of organic functional groups,
3 metal chelates, organometallic compounds and combinations thereof.

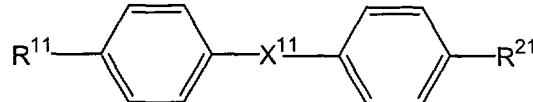
133. (New) The method according to claim 132, wherein said organic
functional group is a member selected from the group consisting of amines, carboxylic acids,
drugs, chelating agents, crown ethers, cyclodextrins and combinations thereof.

134. (New) The method according to claim 132, wherein said recognition
moiety is biotin.

135. (New) The method according to claim 121, wherein said recognition
moiety is a biomolecule.

136. (New) The method according to claim 135, wherein said biomolecule is a
2 member selected from the group consisting of antibodies, nucleic acids, peptides, enzymes and
3 receptors.

1 137. (New) The method according to claim 121, wherein said mesogenic layer
2 comprises:



5 R¹¹ and R²¹ are members independently selected from the group consisting of
6 alkyl groups, lower alkyl, substituted alkyl groups, aryl groups, acyl groups, halogens, hydroxy,
7 cyano, amino, alkoxy, alkylamino, acylamino, thioamido, acyloxy, aryloxy, aryloxyalkyl,
8 mercapto, thia, aza, oxo, both saturated and unsaturated cyclic hydrocarbons, heterocycles,
9 arylalkyl, substituted aryl, alkylhalo, acylamino, mercapto, substituted arylalkyl, heteroaryl,
10 heteroarylalkyl, substituted heteroaryl, substituted heteroarylalkyl, substituted heterocyclic and
11 heterocyclicalkyl; and

12 X¹¹ is a member selected from the group consisting of —C==N—, -N==N(O)—,
13 -C==N(O)—, —HC==CH—, —C≡C— and —OC(O)—

1 138. (New) The method according to claim 123, wherein said visually
2 detecting detects a change in reflectance, transmission, absorbance, dispersion, diffraction,
3 polarization and combinations thereof, of light impinging on said plurality of mesogens.

139. (New) The method according to claim 121, wherein said mesogenic layer
comprises a polymeric mesogen.

140. (New) The method according to claim 123, wherein said patterned substrate
is a member selected from a rubbed glass substrate and a rubbed organic polymer substrate.--

REMARKS

In the Specification

The Specification has been amended to correct typographical errors and to bring the definitions of certain organic groups into harmony with the claims as filed. Each of these changes is briefly explained below. No new matter is added by any of these amendments.

Amendment 1 is a correction of a typographical error. Support for the addition of the value "200" is found at page 70, line 16.

During review of this application, it was noted that, as presently defined, certain of the definitions for art-recognized organic groups were not in harmony with the claims as filed. The claims specifically noted include claims 39 and 41 (reciting the identity of certain R¹ groups), and 46 and 48 (reciting the identity of certain R² groups). In each of these claims and the broader claims from which they depend (*i.e.*, 36 and 43, respectively) R¹ and R² are defined as groups linking Si to

X¹ and S to X². As such, these groups must be at least *divalent* linking groups. Thus, in the amendments numbered 4, 11 and 14, the word “monovalent” has been deleted. This amendment is supported by the claims as filed. Moreover, it would be immediately apparent to one of skill, on examining the claims, that R¹ and R² cannot be monovalent.

In the application as filed, many of the organic groups are *defined* only as substituents, but they are *claimed* as “central” or backbone groups to which substituents can be attached. As there is adequate support for these groups having both a substituent and “central” group character, a number of the definitions have been amended to include both these characteristics of the organic groups. Since the definitions as amended are no longer specific to the substituent character of the organic groups, the term “nucleus” is removed from the definitions by amendment and replaced with a recital that the groups are linked to or integral to either R¹ or R².

These amendments merely correct obvious errors in the Specification. One of skill in the art, on examining the claims and the definitions in tandem would recognize that the two were not in harmony. Moreover, one of skill would have realized that by making the present amendments to the definitions the claims and the definitions could be brought into harmony. Thus, no new matter is introduced by these amendments. *See*, for example, *In re Oda*, 170 USPQ 260 (CCPA 1971).

In the Claims

Claims 121-138 are pending in the present application. Each of the pending claims is directed to a method of detecting an analyte using a device based upon a patterned surface. The use of patterned surfaces in the methods of the invention is fully supported by the specification as filed. *See*, for example, page 26, line 8 to page 28, line 5. No new matter is added by the new claims presented herein for examination on their merits.

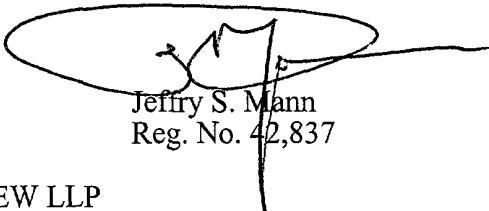
Claims directed to the method of the invention in which the surface is not explicitly claimed as patterned are included in copending U.S. Patent Application No. 09/127,382 (“382”). The analogous method claims of the ‘382 application are allowed. Applicants submit that the addition of the element of a using a patterned surface in the method does not raise an issue of patentability over the art of record in the ‘382 application.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 415-576-0200.

Respectfully submitted,



Jeffry S. Mann
Reg. No. 42,837

TOWNSEND and TOWNSEND and CREW LLP
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FAX 415-576-0200

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the specification:

(1). At page 1, beneath the title please add:

--Cross Reference to Related Applications

This application is a continuation of U.S. Patent Application No. 09/127,382, filed on July 31, 1998, which is a continuation in part of U.S. Patent Application No. 09/092,453, filed on June 5, 1998, now abandoned, the disclosures of both of which are incorporated herein by reference in their entirety for all purposes.--

(2). At page 9, starting on line 21, please replace the fifth paragraph with the following:

--Fig. 1B is a scanning tunneling microscopy image of the surface of a thin (~ 10 nm), semitransparent, obliquely deposited (50° from normal) gold film prepared by electron beam evaporation onto a glass substrate at 0.02 nm s⁻¹. A layer of titanium (~ 200 nm, also deposited obliquely) was used to promote adhesion between the gold and the glass. The vertical and horizontal dimensions of the image are 300 nm and 500 nm, respectively. The gray scale of contrast represents a height range of 0 to 5 nm.--

(3). At page 16, please replace the paragraph beginning on line 17 with the following:

--The term "alkyl" is used herein to refer to a branched or unbranched, saturated or unsaturated, [monovalent] hydrocarbon radical having from 1-30 carbons and preferably, from 4-20 carbons and more preferably from 6-18 carbons. When the alkyl group has from 1-6 carbon atoms, it is referred to as a "lower alkyl." Suitable alkyl radicals include, for example, structures containing one or more methylene, methine and/or methyne groups. Branched structures have a branching motif similar to i-propyl, t-butyl, i-butyl, 2-ethylpropyl, etc. As used herein, the term encompasses "substituted alkyls."--

(4). At page 17, please replace the second paragraph (lines 8-10) with the following:

--The term "arylalkyl" is used herein to refer to a subset of "aryl" in which the aryl group is [attached to the nucleus] linked to or integrated into R¹ or R² shown in Formulae 1 - 4 by an alkyl group as defined herein.--

(5). At page 17, please delete the fourth paragraph (lines 18-20) and replace it with the following:

--"Substituted arylalkyl" defines a subset of "substituted aryl" wherein the substituted aryl group is [attached to the nucleus] linked to or integrated into R¹ or R² shown in Formulae 1 - 4 by an alkyl group as defined herein.--

(6). At page 18, please replace the second paragraph (lines 4-7) with the following:

--As used herein, the term "acylamino" describes [substituents] functional groups of the general formula RC(O)NR', wherein R' is a lower alkyl group and R represents a component of either R¹ or R² [the nucleus] shown in Formulae 1 - 4 or an alkyl group, as defined herein, attached to either R¹ or R² [the nucleus].--

(7). At page 18, please replace the third paragraph (lines 8-14) with the following:

--The term "acyloxy" is used herein to describe an organic radical derived from an organic acid by the removal of the acidic hydrogen. Simple acyloxy groups include, for example, acetoxy, and higher homologues derived from carboxylic acids such as ethanoic, propanoic, butanoic, *etc.* The acyloxy moiety may be oriented as either a forward or reverse ester (*i.e.* RC(O)OR' or R'OC(O)R, respectively), and may be integral to R¹ or R² or a substituent of R¹ or R², wherein R comprises a [the] portion of the ester [attached either directly or through an intermediate hydrocarbon chain to the nucleus] derived from R¹ or R² shown in Formulae 1 - 4.--

(8). At page 18, please replace the fourth paragraph (lines 15-18) with the following:

--As used herein, the term "aryloxy" denotes aromatic groups which are linked to [the nucleus] R¹ or R² or are a constituent of R¹ or R² shown in Formulae 1 - 4, directly through an oxygen atom. This term encompasses "substituted aryloxy" moieties in which the aromatic group is substituted as described above for "substituted aryl."--

(9). At page 18, please replace the fifth paragraph (lines 19-23) with the following:

--As used herein "aryloxyalkyl" defines aromatic groups attached, through an oxygen atom to an alkyl group, as defined herein. The alkyl group is [attached to the nucleus] linked to or integrated into R¹ or R² as shown in Formulae 1 - 4 by an alkyl group as defined herein shown in Formula 1 - 4. The term "aryloxyalkyl" encompasses "substituted aryloxyalkyl" moieties in which the aromatic group is substituted as described for "substituted aryl."--

(10). At pages 18 and 19, please replace the last paragraph starting on page 18 (lines 30-31) and ending on page 19 (lines 1-2) with the following:

--The term "unsaturated cyclic hydrocarbon" is used to describe a [monovalent] non-aromatic group with at least one double bond, such as cyclopentene, cyclohexene, *etc.* and substituted analogues thereof. These cyclic hydrocarbons can be single- or multi-ring structures.--

(11). At page 19, please replace the third paragraph (lines 13-15) with the following:

--"Heteroarylalkyl" defines a subset of "heteroaryl" wherein an alkyl group, as defined herein, links the heteroaryl group or integrates it into [to the nucleus] R¹ or R² shown in Formulae 1 - 4.--

(12). At page 19, please replace the fifth paragraph (lines 23-25) with the following:

--"Substituted heteroarylalkyl" refers to a subset of "substituted heteroaryl" as described above in which an alkyl group, as defined herein, links the heteroaryl group or integrates it into [to the nucleus] R¹ or R² shown in Formulae 1 - 4.--

(13). At page 19, please replace the sixth paragraph (lines 26-30) with the following:

--The term "heterocyclic" is used herein to describe a [monovalent] saturated or unsaturated non-aromatic group having a single ring or multiple condensed rings from 1-12 carbon atoms and from 1-4 heteroatoms selected from nitrogen, sulfur or oxygen within the ring. Such heterocycles are, for example, tetrahydrofuran, morpholine, piperidine, pyrrolidine, *etc.*--

(14). At page 20, please replace the second paragraph (lines 3-5) with the following:

--The term "heterocyclicalkyl" defines a subset of "heterocyclic" wherein an alkyl group, as defined herein, links the heterocyclic group or integrates it into [to the nucleus] R^1 or R^2 shown in Formulae 1 - 4.--

(15) At pages 79 and 80, please replace the last paragraph on page 79, beginning on page 79 (lines 29-34) and ending on page 80 (lines 1-5) with the following:

--In contrast to grating B, the diffraction of light by the grating in Fig. 15C (grating C) was polarization insensitive. When grating C was viewed under crossed polars, either uniformly bright stripes (Fig. [17]18D polarization of incident light between x and y) or uniformly dark stripes (polarization of incident light along x or y) was observed. The boundaries between stripes, which correspond to regions in which two different distortions of the mesogens meet, were visible in the optical micrographs (dark lines in Fig. [17]18D). The lack of measurable contrast between adjacent stripes for all polarizations of incident light is consistent with the mesogenic layer structure of grating C. A similar type of layer structure has been reported by Chen and co-workers who use a two-step rubbing process (Chen *et al.*, *Appl. Phys. Lett.* **67**, 2588 (1995)).--

(16) At page 80, please replace the third paragraph (lines 15-32) with the following:

--Tuning of these patterned mesogen structures was possible by using electric fields. When gold surfaces supporting SAMs were used as electrodes, an electric field could be applied perpendicular to the surfaces. Reversible application of the electric field reorients the mesogens and thus modulated the intensity of light diffracted from the gratings (Fig. [18]19E). In-plane electric fields were also used (in-plane switching refers to the use of an electric field that is applied parallel to the surface of the cell). Devices based on in-plane switching of a mesogen have been used in FPDs with wide viewing angles (Ohe *et al.*, *Appl. Phys. Lett.* **69**, 623 (1996); Ohta *et al.*, *IEICE (Inst. Electron. Inf. Commun. Eng.) Trans. Electron.* **E79-C**, 1069 (1996)) to reorient these patterned mesogenic structures. We observe SAMs to be stable upon application of an electric field across a cell filled with mesogen. Past studies have reported electrochemical desorption of SAMs in aqueous solutions of electrolytes (Widrig *et al.*, *J. Electroanal. Chem.* **310**, 335 (1991); Waliquid crystalzak *et al.*, *Langmuir* **7**, 2687 (1991)). In general, the alignment of mesogens on SAMs formed from

long-chain alkanethiols is stable over months. Stability over years can be achieved by using polymerizable SAMs (T. Kim *et al.*, *Langmuir* **12**, 6065 (1996)) or mesogens doped with alkanethiols or reducing agents to prevent oxidative degradation of the SAMs.--

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

IN THE CLAIMS:

Claims 1-120 have been canceled. Please replace claims 1-120 with the following claims 121-140:

1 --121. (New) A method of visually detecting an analyte-recognition moiety
2 complex formed by an interaction between an analyte and a recognition moiety for said analyte
3 by transducing said interaction to an organic mesogenic layer, said method comprising:

4 (a) interacting said analyte with a patterned surface comprising said recognition
5 moiety, thereby forming an analyte-recognition moiety complex, said surface comprising:

6 (i) a substrate;

7 (ii) a self-assembled monolayer bound to said substrate; and

8 (iii) said recognition moiety bound to said self-assembled monolayer;

9 (b) contacting said analyte-recognition moiety complex with said organic
10 mesogenic layer, thereby anchoring said organic mesogenic layer onto said self-assembled
11 monolayer and causing at least a portion of a plurality of mesogens proximate to said recognition
12 moiety to detectably switch from a first orientation to a second orientation, thereby transducing
13 said interaction to said mesogenic layer, said transducing causing said mesogenic layer to
14 register a visually detectable feature; and

15 (c) visually detecting said feature.

1 122. (New) The method according to claim 121, wherein said patterned surface
2 comprises a patterned self-assembled monolayer.

1 123. (New) The method according to claim 121, wherein said patterned surface
2 comprises a patterned substrate.

1 124. The method according to claim 121, wherein said patterned surface is
2 produced by a method which is a member selected from the group consisting of grooving,
3 photolithography, photoetching, chemical etching, mechanical etching, microcontact printing and
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1 126. (New) The method according to claim 125, wherein said patterned surface
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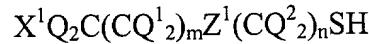
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1 129. (New) The method according to claim 127, wherein each member of said
2 plurality of wells comprises a depression and at least one border, wherein said border extends
3 vertically above said depression and said border comprises a compound which is a member
4 selected from the group consisting of hydrophobic compounds, hydrophilic compounds and
5 charged compounds.

1 130. (New) The method according to claim 121, wherein said patterned surface
2 anchors said mesogenic layer.

1 131. (New) The method according to claim 121, wherein said self-assembled
2 monolayer is formed from:



3 wherein,

4 5 X^1 is a member selected from the group consisting of H, halogen and recognition
6 6 moieties;

7 7 Q, Q^1 and Q^2 are independently members selected from the group consisting of H
8 8 and halogen;

Z^1 is a member selected from the group consisting of $-\text{CQ}_2-$, $-\text{CQ}_1^1-$,
 $-\text{CQ}_2^2-$, $-\text{O}-$, $-\text{S}-$, $-\text{NR}^4-$, $-\text{C}(\text{O})\text{NR}^4$ and $\text{R}^4\text{NC}(\text{O})-$,
in which:

R^4 is a member selected from the group consisting of H, alkyl, substituted alkyl, aryl, substituted aryl, heteroaryl and heterocyclic groups;

m is a number between 0 and 40; and

n is a number between 0 and 40.

132. (New) The method according to claim 121, wherein said recognition moiety comprises a member selected from the group consisting of organic functional groups, metal chelates, organometallic compounds and combinations thereof.

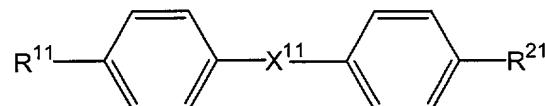
133. (New) The method according to claim 132, wherein said organic functional group is a member selected from the group consisting of amines, carboxylic acids, drugs, chelating agents, crown ethers, cyclodextrins and combinations thereof.

134. (New) The method according to claim 132, wherein said recognition moiety is biotin.

135. (New) The method according to claim 121, wherein said recognition moiety is a biomolecule.

136. (New) The method according to claim 135, wherein said biomolecule is a member selected from the group consisting of antibodies, nucleic acids, peptides, enzymes and receptors.

137. (New) The method according to claim 121, wherein said mesogenic layer comprises:



wherein,

5 R¹¹ and R²¹ are members independently selected from the group consisting of
6 alkyl groups, lower alkyl, substituted alkyl groups, aryl groups, acyl groups, halogens, hydroxy,
7 cyano, amino, alkoxy, alkylamino, acylamino, thioamido, acyloxy, aryloxy, aryloxyalkyl,
8 mercapto, thia, aza, oxo, both saturated and unsaturated cyclic hydrocarbons, heterocycles,
9 arylalkyl, substituted aryl, alkylhalo, acylamino, mercapto, substituted arylalkyl, heteroaryl,
10 heteroarylalkyl, substituted heteroaryl, substituted heteroarylalkyl, substituted heterocyclic and
11 heterocyclicalkyl; and

12 X¹¹ is a member selected from the group consisting of —C=N—, -N=N(O)—,
13 —C=N(O)—, —HC=CH—, —C≡C— and —OC(O)—

138. (New) The method according to claim 123, wherein said visually detecting detects a change in reflectance, transmission, absorbance, dispersion, diffraction, polarization and combinations thereof, of light impinging on said plurality of mesogens.

139. (New) The method according to claim 121, wherein said mesogenic layer comprises a polymeric mesogen.

140. (New) The method according to claim 123, wherein said patterned substrate is a member selected from a rubbed glass substrate and a rubbed organic polymer substrate.--